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<p>(54) Title: DIRECT BROADCASTING SATELLITE ARCHITECTURE FOR VIDEO-ON-DEMAND AND INTERACTIVE SERVICES</p>			
<p>(57) Abstract</p> <p>A terrestrial base station including for providing at least near video-on-demand, includes an antenna for receiving a plurality of programs in the form of encoded signals from a satellite system, a decoder for decoding the signals, and a mass storage device coupled to the decoder, for storing at least some of the plurality of programs. A suitably programmed processor determines which of the plurality of programs to store in the mass storage device, based on predetermined criteria.</p>			

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DIRECT BROADCASTING SATELLITE ARCHITECTURE FOR VIDEO-ON-DEMAND AND INTERACTIVE SERVICES

This invention relates generally to near video on demand (VOD), and more particularly relates to a system and method of providing personalized near video on demand and interactive communications services.

Direct broadcasting satellite technology as usually conceived is suitable for delivering large numbers of video channels over wide geographic areas on a point-to-multipoint basis. It is fundamentally a one-way medium, with a geostationary satellite broadcasting to small, low cost, individually addressable home receivers. Signals are encrypted, with decryption enabled in subscribing receivers. Digital video compression (DVC) is applied to the video signals to conserve satellite capacity required.

The home receivers comprise an outdoor unit which consists of an antenna and low noise down converter, and an indoor unit. The indoor unit comprises a demodulator and demultiplexor to permit channel selection, a control unit for address decoding and decryption control, an interface control unit accessible with a hand held remote control, and a DVC decoder. The interface control unit enables the user to select channels, display schedule information, carry out user control functions such as parental control, channel lockout, and display messages addressed to a particular receiver. It may also have a billing function if it is used to authorize Pay-per-View viewing from a debitible credit account established within it.

Interactive multimedia and VOD services are not normally provided by a DBS system because the medium is one-way and is cost effective for mass distribution, not for services to individuals.

An object of the invention is to address this problem.

According to the present invention there is provided a system for providing at least near video on demand, comprising multimedia server means providing a source of program material; a satellite communications system for broadcasting the program material to a plurality of users; an at least one receiving station comprising antenna means for receiving a plurality of programs in the form of encoded signals from the satellite system, a decoder for decoding said signals, mass storage means coupled to said decoder,

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for storing at least some of said plurality of programs, and programmed processor means for determining which of said plurality of programs to store in said mass storage means based on predetermined criteria selected by the user.

This invention provides a system architecture which permits the use of both direct broadcasting satellite (DBS) technology and terrestrial integrated services digital network (ISDN) facilities (or other similar terrestrial narrow band data transmission facilities) to provide interactive multimedia and emulated video-on-demand (VOD) services to residential consumers. Both of these technologies are in place or are being put in place, requiring little or no further investment in basic infrastructure on the part of the respective service providers. A key addition to the architecture is the incorporation of high capacity data storage in the equipment in the home to store DBS delivered video information along with Personal Agent software to assist in the selection of material to be stored, as well as in the provision of this material to the user on an "on-demand" or NVOD basis.

The integrated combination of DBS, terrestrial data transmission facilities such as ISDN, and high capacity data storage permits interactive VOD service to be emulated using satellite delivery. DBS provides the wideband link to the home for broadcast or narrowcast video which can be stored for access by the user on demand. ISDN provides a narrowband link to the home, but it is two-way and suitable for interactive services which are individually addressable. In combination with down loaded stored video information, this can provide full interactive multimedia capability to the home.

The Personal Agent software assists in the selection of broadcast video and digital information material to be stored, at the request of the user, and on the basis of the user's interest profile which he/she will provide. In many instances the user will select in advance the material desired to be saved for later use. The Personal Agent software is intended to automate the process by saving all material which matches the user's interest profile for subsequent review/viewing by the user and his/her subsequent decision to retain or discard. Particular programming of interest would be retained for a prescribed period before automatic or user-prompted deletion. The use of this intelligent agent in combination with the other system components will effectively provide an NVOD capability.

All agents have a repertoire that incorporates rules and thereby determines actions.

Intelligent agents also incorporate learning. By providing a learning function, an intelligent agent can update its rules based on outcomes of previous decisions in an attempt to improve a quality of service. An agent acts on behalf of an individual and performs tasks requested by or for the benefit of that individual.

The personal agent software described herein can be implemented in any of a number of ways. Such an agent searches available broadcast material for that material which is of interest to the individual. Material of interest is defined by the individual; the agent is capable of learning, and can improve searches through feedback regarding previously retrieved broadcasts.

Initially, prior to performing a search, an agent is provided with preferences in the form of parameters or limitations by which to confine or direct a search. Parameters may include topics or subject matter, directors, producers, stars, ratings, company, or title. Limitations may include rating based limitations on access for those under a certain age, it may include filters to ignore eligible broadcasts covering certain material or containing certain references, it may restrict the eligible broadcasts by company, producer, director, actor etc. The agent will adhere to the provided preferences. Alternatively, when the agent is capable of learning and will modify the search parameters within the context of previous broadcasts that have been rated by the individual.

In an embodiment, each broadcast is provided with header information containing a sufficient amount of information to allow personal agents to review the material to be broadcast and to apply rules to select the programs for storage. Such an embodiment is limited in several ways. A program may last longer than a single time slot and may, if stored, prevent storage of later, more interesting programs. Further, the agent would be incapable of creating a schedule in advance, which an individual can review. Finally, the agent must constantly monitor all broadcast signals and communicate all decisions in a storage medium of the individual.

In an alternative embodiment, header information is stored in at least a central location in whole or in part and retrieved from the at least a location by a personal agent in order to review broadcast schedules, apply rules, and create a schedule for program storage. Such a schedule may span a predetermined time or may be determined by the agent's prior experience with rearranging schedules. Personal agents are notified of

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changes in the broadcast schedules to ensure that stored programs are desirable.

A personal agent is informed of user preference changes in the form of changes to parameters or limitations. The changes may become effective at some future time, in which case the agent will schedule the changes to occur at that time, or they may be effective immediately and retroactively. In the later case, the agent will review the existing program storage schedule in order to apply the new parameters and limitations. Changes in weighting of different parameters and limitations result in the agent contacting at least a central location, re-reviewing broadcast schedules, and re-creating the schedule for program storage. Further, when time permits, a schedule for program storage is provided to the individual to review prior to implementation. Such review allows the individual to arbitrate between simultaneous broadcasts and to review available programs meeting the parameters and limitations set out in the individual's preferences. Further, such review provides valuable information to the agent when it is capable of learning.

The invention still further provides a method of providing at least near video on demand, comprising the steps of: providing a source of program material; broadcasting the program material to a plurality of users over a satellite communications system; receiving said material at a receiving station in the form of encoded signals from the satellite system; decoding said signals; storing at least some of said plurality of programs in a mass storage device at said receiving station; and determining which of said plurality of programs to store in said mass storage means based on predetermined criteria selected by the user.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram of a NVOD system in accordance with the invention; and

Figure 2 illustrates one embodiment of a personal agent for use with the system.

In Figure 1, a home 1 communicates over a two-way ISDN 2B+D link 2 with a local central office 3 in turn connected to a remote central office 4. The remote central office is connected over a narrow band link 5 carrying multimedia signals to multimedia

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service providers 6. The service providers 6 are connected over a wideband video link 7 to a satellite base station 8, which sends signals over uplink 9 to satellite 10 for broadcast to home antenna 11.

The antenna 11 is connected to a conventional DBS receiver 12 associated with an ISDN decoder 13 and program storage device 14.

Loop terminating device 15 is connected to the ISDN link and connected via bus 16 to the ISDN set top decoder 13, computer 17, and terminal adapter 18, which may be connected to analog devices (not shown). The program storage device 14 is also connected to the computer 17 and television set 19. Processor 25, associated with the DBS receiver 12, is programmed to permit the user to determine what material will be stored in accordance with user selected criteria. The processor 25 includes personal agent software for this purpose, which is described in more detail with reference to Figure 2.

The local central office 3 comprises a server switch 20 with an ISDN line card connect to the ISDN link 2. The local server switch 20 is connected over trunk 22 to the ISDN switch 23 in the remote central office 4.

The multimedia service provider 6 consists of a number of multimedia servers 24 each storing multimedia material for distribution to customers. Typical multimedia services include Network TV; Home Banking; Specialty TV; Financial Services; Pay TV; Reservations-theater, restaurant, etc; Pay per View Movies; Travel Reservations; Pay per View Special Events; Community Services; Home Shopping; Health Services; Educational Courses; Services Directory; Training Courses; Library Browsing; "How To" Programs; Computer Networking; Hobbies; Electronic Mail; Games; Computer Bulletin Boards; Audio Stories, Books; Facsimile; Music; Telecommuting; Videophone; and Information Services

The service providers 6 make use of both DBS and terrestrial data transmission technology, such as ISDN technology to provide a wide range of multimedia services to their customers. The multimedia servers 24 are used to originate the services. Wide band, video signals are transmitted via the DBS system including satellite 10, while narrow band signals falling within the capability of ISDN are transmitted using ISDN network facilities 20, 23. Some services comprise both wide band and narrow band

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signals and use a combination of DBS and ISDN or a similar narrow band data transmission technology.

The central offices 3, 4 and associated two-way ISDN links provide a narrow band return path to the multimedia servers 24 to permit interactivity and also to carry narrowband material, such as billing information, that does not justify the use of the wideband satellite link.

Video transmitted on the DBS system may be viewed in real time in the conventional manner on television set 19 or it may be recorded by the program storage device 14 incorporated in the DBS receiver or set-top multimedia decoder for later viewing. Depending on the type of service, the stored video material may be requested directly by the user for display on TV 19 or computer display 17. In this mode, because the video material is stored, the user is be able to search through it to select the portion he/she wished to view, pause, go backward or forward, view frame by frame, or repeat viewing. If the video material is part of an interactive service which includes terrestrially transmitted material, display of the video portion may be controlled from the multimedia server via the terrestrial line.

The program storage device can be associated with either the DBS receiver 12 as shown or it could be a stand alone device. In a preferred embodiment, in a consumer product the indoor unit of the DBS receiver, the multimedia decoder, and the program storage devices are packaged as one set-top unit and incorporate an infrared remote control device. Residential consumer user equipment includes a TV and a stereo sound system.

All of the residential premises equipment is presently commercially available on a stand-alone basis or readily adaptable by one skilled in the art from existing equipment. The set-top multimedia decoder 13 falls into the latter category, and can most easily realized by adapting a DBS or cable TV set-top device. This invention integrates the set-top unit functions of the DBS receiver and the multimedia decoder with high capacity data storage, and incorporates all of the required functionality in appropriate software to emulate interactive VOD and other multimedia services. The Personal Agent software is included in the set-top box software modification.

A variety of data storage technologies are applicable for the program storage device 14. These include magnetic tape, magnetic disc, magneto-optic disc and optical storage. Capacity for storing four hours of DVC video information is considered to be the minimum capacity required, with 10 to 20 hours preferred. Other desired attributes of the storage technology applied include virtually instantaneous access, certainly within seconds, and a capability to record information at higher than real time speeds, by a factor of 10 to 20. This permits the option of rapid downloading of information as well as real time recording. A combination of storage technologies may be applied to achieve the desired set of attributes. For example, magnetic tape may provide the high capacity and be used in an archival storage mode, with magnetic disc providing the rapid access by transferring information desired for current use from tape to disc.

Optical data storage technologies hold out the promise of providing high capacity, hundreds or thousands of gigabytes, rapid random access, and very high input and output transfer rates. However, they are not yet commercially available, although they are forecast to be within the next decade or so.

The type of equipment required by multimedia service provider 6 depends upon the type of service being provided. For example, a pay per view movie service or any other video information service requires archival storage, which can be tape or video disc, and transmission facilities to the DBS uplink terminal. In accordance with this invention, requests for particular movies are received via the terrestrial data facility, which is also used to provide the return information to the requester concerning transmission schedule for the requested movie.

An interactive educational or training service also uses a video server and augments this with a computer for multimedia graphics, text, and audio material as well as for interactive conduct of the course being given. Again all but the video information is communicated with the user via the terrestrial data facility.

Some multimedia services such as home banking, financial services, electronic mail, reservation services, etc., may not have any associated video information and may require only the terrestrial data portion of the architecture described here for connection to the user. Billing associated with any of the services being provided would also require only the data facility.

Formatting of multimedia material may take advantage of the maximum transmission capacity of the terrestrial data link. Assuming an ISDN basic rate (2B+D) with a maximum throughput of 144 kb/s, the use of a buffering technique permits the transmission of material which exceeds this rate for short periods of time if it is time averaged with material which falls below this rate, for example, audio or text. Thus even short video clips or partial screen full motion displays exceeding 144 kb/s may be transmitted via ISDN and not require transmission via DBS. This offers further flexibility in configuring multimedia services.

The terrestrial data portion of the architecture is that provided as a standard service offering by the telephone companies, such as ISDN. It involves switches equipped with ISDN software in the telephone company central offices, ISDN line cards to serve individual subscribers, and interconnection for ISDN service between central offices. If the subscriber's central office is not equipped with ISDN software and hardware, then a remote unit 23 connected to a distant ISDN switch may be used as shown in Figure 1. The existing twisted copper pair loop 2 to the subscriber capable of delivering ISDN basic rate service (2B+D) is an adequate connection. Dedicated lines may be required between multimedia service providers and the ISDN network.

The DBS portion of the architecture described herein is that typically associated with a DBS service. It comprises a high powered satellite 10 transmitting signals capable of being received with small antennas, usually less than a metre in diameter. One or more uplink earth stations 8 are used to feed the satellite. DVC (Digital Video Compression) is used at the uplink earth stations to compress the video signals to conserve spectrum and satellite power and thus to make more efficient use of satellite capacity. For this purpose uplink station has a compressor unit 26 and the home 1 is provided with a decompressor 27. Any suitable video compression software can be employed. Direct satellite broadcasting is usually carried out at Ku band frequencies, either in the Broadcasting Satellite Service (BSS) band or the Fixed Satellite Service (FSS) band, but may also be carried out in other satellite service frequency bands. When not specifically in the BSS band, direct satellite broadcasting is often described as direct-to-home (DTH) satellite service.

One deviation from a nominal DBS system possible with the architecture

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described herein is to transmit compressed video at a higher than real time viewing rate and to record the signal for subsequent viewing. Thus a movie may be sent in a few minutes rather than its typical normal time of two hours. Some of the capacity of the DBS system within the architecture described could be reserved for such a high speed down loading service.

The personal agent implemented on the processor 25 is shown in more detail in Figure 2. The personal agent includes a routine 50 which loads rules parameters or new rules governing the operation of the system from the personal computer 17. These can be input into the PC 17 by the user. Similarly routine 51 loads profile criteria or new profile criteria relating, for example, to the particular programs or type of programs that the user wants to access. Routine 52 compares the criteria and rules received from routines 50, 51 with the program headers associated with the received material. These can be added by the broadcasters or derived from the broadcast material using intelligent software responsive to program content.

In response to the previous routines the personal agent saves programs matching the profile criteria at 54 and creates a storage contents listing in routine 54. Routine 55 displays the contents listing upon request.

Block 56 represents the learning mode which enables the agent to learn what type of programs the user is interested in based on past experience. Routine 57 receives feedback relating to saved programs and passes this information to routine 58 which passes it back to routine 50 that is responsible for loading the rules parameters.

By incorporating high capacity data storage with both DBS and terrestrial data transmission technologies and using all three components combined in an innovative fashion with a Personal Agent, VOD or NVOD services can be emulated in residential premises without further investment in network infrastructure. Thus this invention can result in the deferral or avoidance of billions of dollars of investment in fibre optic or two-way coaxial cable plant.

Claims:

1. A system for providing at least near video on demand, comprising:
multimedia server means providing a source of program material;
a satellite communications system for broadcasting the program material to a plurality of users; and
at least one receiving station comprising:
antenna means for receiving a plurality of programs in the form of encoded signals from the satellite system;
a decoder for decoding said signals;
mass storage means coupled to said decoder, for storing at least some of said plurality of programs; and
programmed processor means for determining which of said plurality of programs to store in said mass storage means based on predetermined criteria selected by the user.
2. A system as claimed in claim 1, further comprising a terrestrial link from said multimedia server means to said at least one receiving station for carrying narrowband upstream material and also providing a return path from said at least one receiving station to said multimedia servers.
3. A system as claimed in claim 2, wherein said terrestrial link is an ISDN link.
4. A system as claimed in claim 1 or 2, wherein said decoder is in the form of a TV set-top multimedia decoder.
5. A system as claimed in any one of claims 1 to 4, wherein said at least one receiving unit includes a DBS receiver.
6. A system as claimed in any one of claims 1 to 5, wherein said programmed processor means includes a personal agent for determining programs that are to be stored in the mass memory.
7. A system as claimed in claim 6, wherein said personal agent is programmed with user preferences to be used for determining which programs are to be stored.
8. A system as claimed in any one of claims 1 to 7, further comprising means for

compressing said program material for broadcast to said at least one receiving station in compressed form.

9. A system as claimed in claim 2, wherein said receiving station comprises a bus connected to a network terminal adapter, and said bus is connected to a computer and said programmed processor means.

10. A system as claimed in claim 9, wherein said bus is also connected to said decoder to permit said computer to receive interactive multimedia material over said satellite communications system.

11. A method of providing at least near video on demand, comprising the steps of: providing a source of program material;

broadcasting the program material to a plurality of users over a satellite communications system;

receiving said material at a receiving station in the form of encoded signals from the satellite system;

decoding said signals;

storing at least some of said plurality of programs in a mass storage device at said receiving station; and

determining which of said plurality of programs to store in said mass storage means based on predetermined criteria selected by the user.

12. A method as claimed in claim 11, wherein a terrestrial link from said multimedia server means to said at least one receiving station carries narrowband upstream material and also provides a return path from said at least one receiving station to said multimedia servers.

13. A method as claimed in claims 11 or 12, further comprising compressing said program material for broadcast to said receiving station in compressed form.

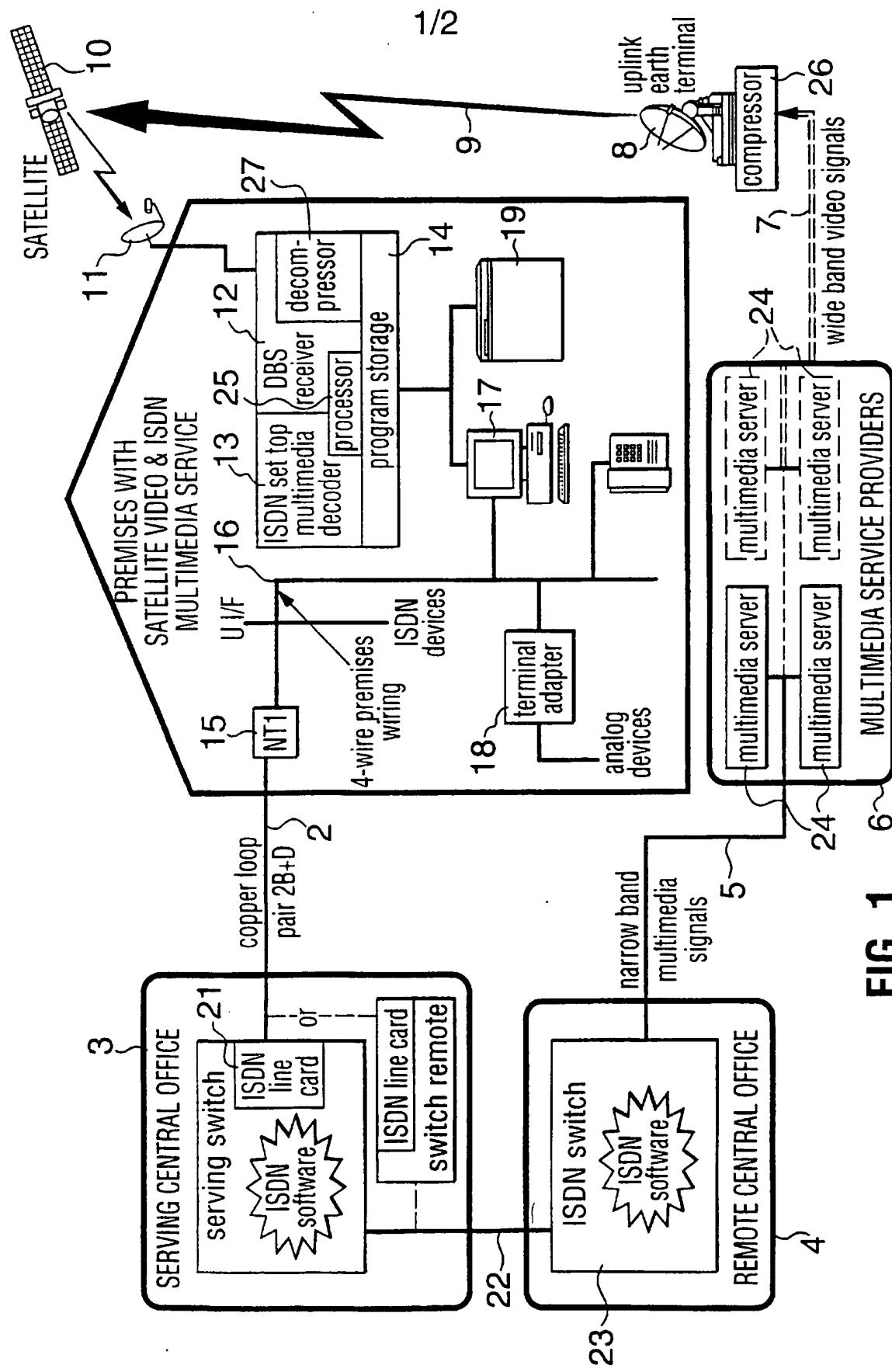
14. A method as claimed in any one of claims 11 to 13, further comprising transmitting interactive multimedia material over said satellite communications system.

15. A receiving station for receiving at least near video on demand comprising: antenna means for receiving a plurality of programs in the form of encoded signals from the satellite system;

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a decoder for decoding said signals;
mass storage means coupled to said decoder, for storing at least some of said plurality of programs; and
programmed processor means for determining which of said plurality of programs to store in said mass storage means based on predetermined criteria selected by the user.

16. A receiving station as claimed in claim 15, wherein said programmed processor means includes a personal agent for determining programs that are to be stored in the mass memory.



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PERSONAL AGENT HIGH LEVEL FLOW CHART

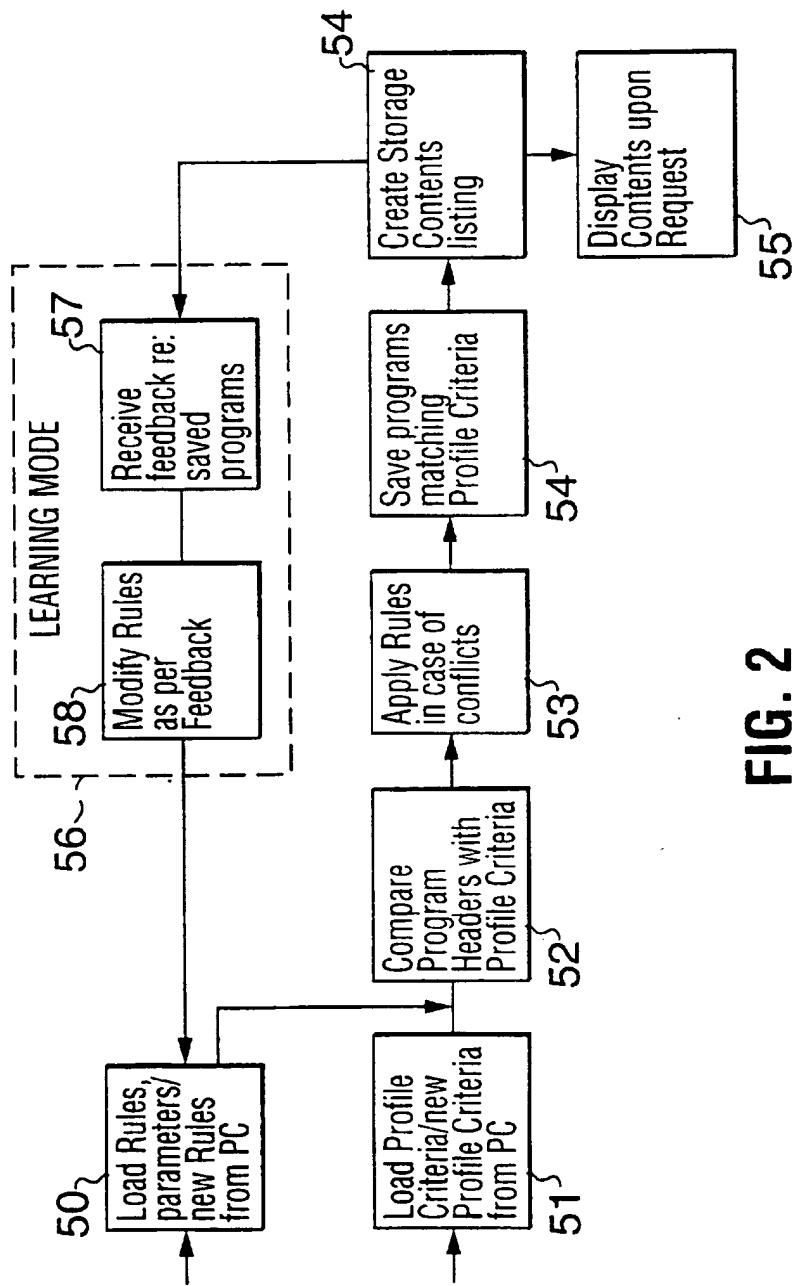


FIG. 2

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/CA 97/00444

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 04431 A (ELECTRONIC DATA SYST CORP) 9 February 1995 see page 4, line 20 - page 9, line 5 see figure 1 ---	1-16
A	K. HARDER: "DIGITALES FERNSEHEN UND MULTIMEDIA BEGRIFFE, TECHNOLOGISCHE PROBLEME, PERSPEKTIVEN" FERNSEH UND KINOTECHNIK, vol. 50, no. 1, 1 January 1996, HEIDELBERG, DE, pages 41-45, XP000555569 see the whole document ---	1-16 -/-

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Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No
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C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HIRTZ G ET AL: "OPEN TV: BETRIEBSSYSTEM FUER INTERAKTIVES FERNSEHEN" FERNSEH UND KINOTECHNIK, vol. 50, no. 3, 1 March 1996, HEIDELBERG, DE, pages 84-89, XP000581417 see the whole document -----	1-16

INTERNATIONAL SEARCH REPORT

Int. Application No
PCT/CA 97/00444

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9504431 A	09-02-95	US 5440336 A AU 7399094 A CA 2167801 A EP 0710420 A JP 9501031 T	08-08-95 28-02-95 09-02-95 08-05-96 28-01-97

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